APPARATUS FOR EXTRUDING MULTIPLE SYNTHETIC RESINS

REFERENCE TO RELATED APPLICATION

This is a continuation of U.S. patent application Ser. No. 07/301,385 filed Jan. 25, 1989, now U.S. Pat. No. 5,104,305 entitled Nozzle Device for Extrusion of Multiple Synthetic Resins.

FIELD OF THE INVENTION

This invention relates to a nozzle device for use in extruding multiple synthetic resins as a resin composite.

DESCRIPTION OF THE PRIOR ART

Japanese Laid-Open Patent Publication No. 184817/1987 discloses a multilayered compression-molded article comprising a first synthetic resin layer and a second synthetic resin layer substantially entirely surrounded by the first synthetic resin layer. This multilayered compression-molded article is embodied conveniently as a container, a container closure or a container closure liner. Generally, the first resin layer is formed of a synthetic resin having excellent mechanical properties and hygienic characteristics, and the second resin layer, from a synthetic resin having excellent gas-barrier property or thermal resistance.

This patent document discloses an extrusion apparatus for extruding multiple synthetic resins as a resin composite containing the first resin and the second resin substantially entirely surrounded by the first resin as materials to be compression-molded into the multilayered article. The extrusion apparatus is provided with a nozzle device including a main extrusion flow passage and a subsidiary extrusion flow passage. At least a downstream portion of the subsidiary extrusion flow passage is disposed within the main extrusion flow passage, and an opening-closing member is provided for opening or closing a subsidiary extrusion opening formed in the downstream end of the subsidiary extrusion flow passage. When the subsidiary extrusion opening intermittently is opened by operating the opening-closing member, the second resin flowing through the subsidiary extrusion flow passage is extruded intermittently into the first resin flowing through the main extrusion flow passage. As a result, a composite comprising the first resin and the second resin surrounded substantially entirely by the first resin is extruded from a main extrusion opening formed in the downstream end of the main extrusion flow passage.

Experiments conducted by the present inventors show that in the nozzle device disclosed in the above-cited patent document, the second resin remains existing in a thread-like form in the first resin even after the subsidiary extrusion opening is closed by the opening-closing member ("roping phenomenon"). In the event that the roping phenomenon occurs, the second resin is not covered with the first resin but exposed to view locally at the time of occurrence of roping, and this will result in delamination between the first resin layer and the second resin layer.

SUMMARY OF THE INVENTION

It is a primary object of this invention to inhibit greatly, or avoid, the occurrence of the roping phenomenon by improving the above nozzle device used for extruding multiple resins as a resin composite.

Another object of this invention is to inhibit greatly, or avoid, the occurrence of the roping phenomenon without unduly complicating the structure and operation of the nozzle device.

Experiments conducted by the present inventors led to the discovery that the occurrence of the roping phenomenon is due mainly to the second resin adhering to the forward end portion of the opening-closing member which has closed the subsidiary opening. Continued studies including additional experiments have now led to the discovery that the occurrence of the roping phenomenon can be inhibited greatly or circumvented by (a) providing an auxiliary extrusion flow passage at least a downstream portion of which extends through the main extrusion flow passage surrounding the downstream portion of the subsidiary extrusion flow passage, and which has an auxiliary extrusion opening at its downstream end downstream of the subsidiary extrusion opening, and (b) forming a tapered part in the downstream end portion of the auxiliary extrusion flow passage so that when the opening-closing member is held at a closing position at which it closes the subsidiary extrusion opening, the resin which flows through the auxiliary extrusion flow passage and is extruded into the main extrusion flow passage from the auxiliary extrusion opening flows while colliding with the forward end portion of the opening-closing member thereby scraping off the resin remaining there. The resin caused to flow through the auxiliary extrusion flow passage may be the same as the first resin flowing through the main extrusion flow passage, or a resin which has excellent adhesion and can be consolidated with it firmly.

Accordingly, the present invention provides a nozzle device for extrusion of multiple synthetic resins as a resin composite, comprising a main extrusion flow passage having a main extrusion opening, a subsidiary extrusion flow passage having a subsidiary extrusion opening, at least a downstream portion of the subsidiary extrusion flow passage being disposed in the main extrusion flow passage, and an opening-closing member for opening or closing the subsidiary extrusion opening; the nozzle device further comprising an auxiliary extrusion flow passage which has an auxiliary extrusion opening and at least a downstream portion of which extends through the main extrusion flow passage as it surrounds the downstream portion of the subsidiary extrusion flow passage, said auxiliary extrusion opening being positioned downstream of the subsidiary extrusion opening and the downstream end portion of the auxiliary extrusion flow passage having a tapered part, and said auxiliary extrusion flow passage being designed such that when the opening-closing member is held at a position at which it closes the subsidiary extrusion opening, a synthetic resin flowing through the auxiliary extrusion flow passage and extruded into the main extrusion flow passage through the auxiliary extrusion opening flows while colliding with the forward end portion of the opening-closing member.

In the nozzle device of this invention, the synthetic resin which flows through the auxiliary extrusion flow passage and is extruded into the main extrusion flow passage from the auxiliary extrusion opening collides with the forward end portion of the opening-closing member at the closing position and effectively scrapes off the synthetic resin remaining there. Accordingly, it can be clearly understood in conjunction with Examples and Comparative Examples given hereinafter that